



## **Planning TRUenergy's future generation mix: can coal and renewables fit together?**

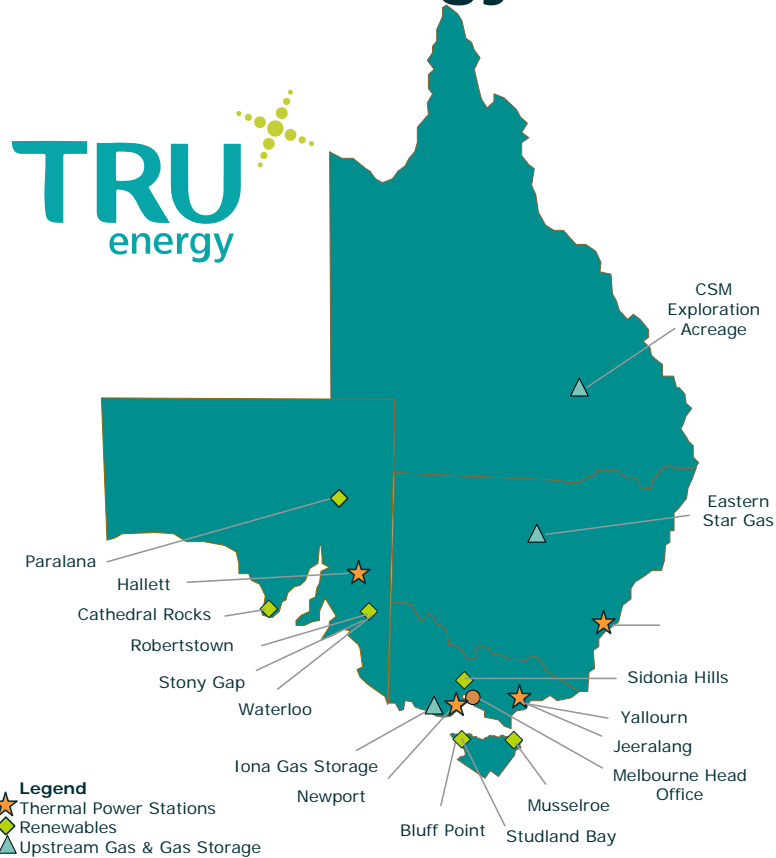
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# Agenda

- About TRUenergy
- Energy's carbon challenge
- Technology is key... but which technology?
- Drivers of change pre-2020
- TRUenergy's generation development path

# TRUenergy's \$5B flexible energy portfolio



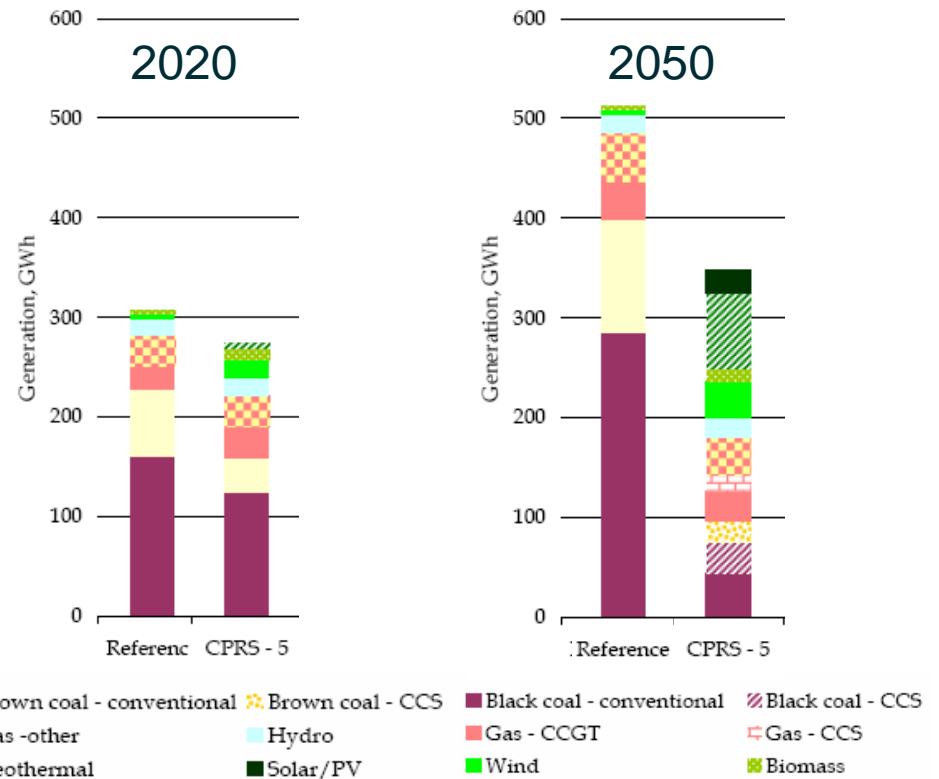
Retail Assets		
Mass market	Electricity ~ 750,000 customer accounts Gas ~ 550,000 customer accounts	
Industrial customers	8.3 TWh	
GreenPower	~150,000 customer accounts	
ConnectNow	50% equity	
Electricity Assets		Total 4,090 (MW)
Yallourn	Coal-fired power station	1,480
Hallett	Gas-fired power station	180
Newport & Jeeralang	Gas-fired power station	966
Tallawarra	Stage A Stage B (development)	420 500
Roaring 40s	Development & management of wind assets	514
Petratherm	30% equity in Paralana project	30
Gas Assets		
Iona gas storage	22 PJ gas storage facility	
Eastern Star Gas	~5% equity	
Upstream gas	Equity in Queensland CSM developments	

Planning TRUenergy's future generation mix



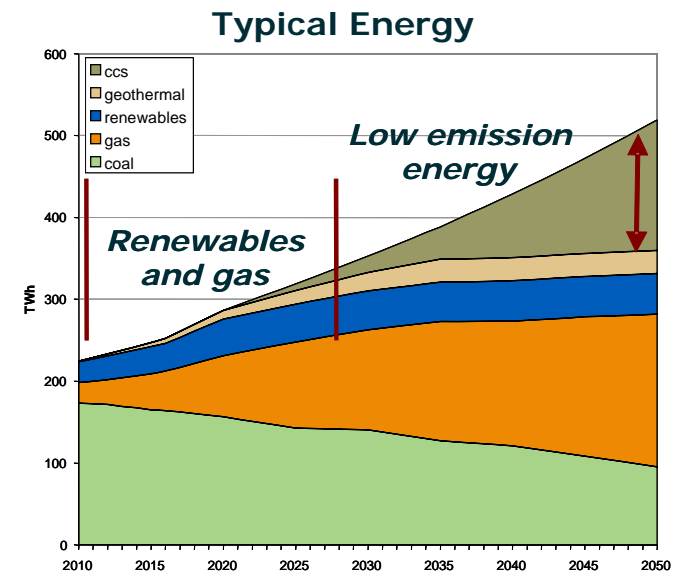
# The energy industry's carbon challenge: a new electricity system by 2050

- ~85% of Australia's electricity is from coal fired power stations
- Australia's average emissions intensity is around ~0.9 t /MWh
- What intensity do we need by 2050?
  - o 60% cut in electricity emissions requires an average market intensity of 0.2 t/MWh
  - o implies we can only use gas diluted with significant volumes of zero or very low emission technologies [carbon capture & storage (CCS), renewables]
- To achieve the targeted abatement required domestically, the entire electricity generation system must be replaced by 2050 (\$50B +)



# The 'winning' technologies to deliver the necessary abatement by 2050 are unknown

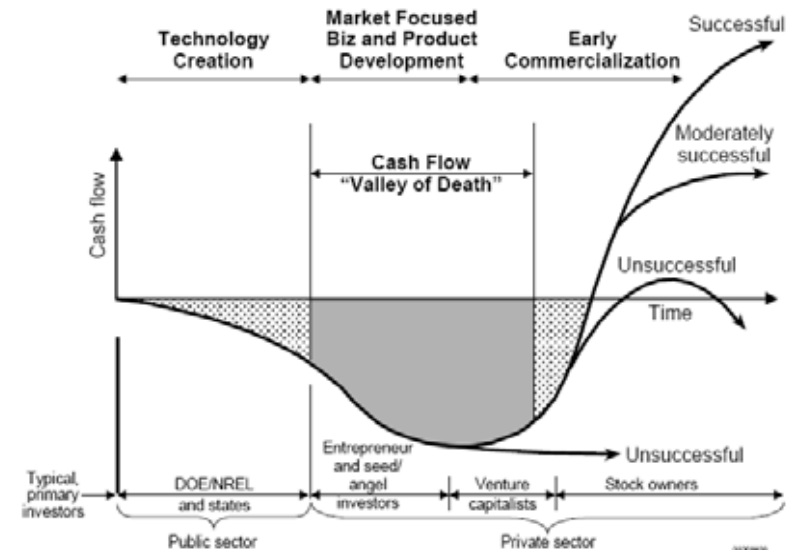
- All modelling assumes very large volumes of new zero or low emission baseload generation, including:
  - Carbon capture and sequestration on coal and/or gas
  - Enhanced geothermal systems
  - Solar
- Few of these technologies are currently commercially deployable
  - Technologies not integrated or built at commercial scale
  - Cannot finance at large scale
- Other technologies may emerge to challenge our assumptions, e.g.:
  - Direct carbon fuel cells
  - Distributed renewables / economic energy storage



# To deliver the abatement needed by 2050, commercial demonstrations must be funded and developed by 2020

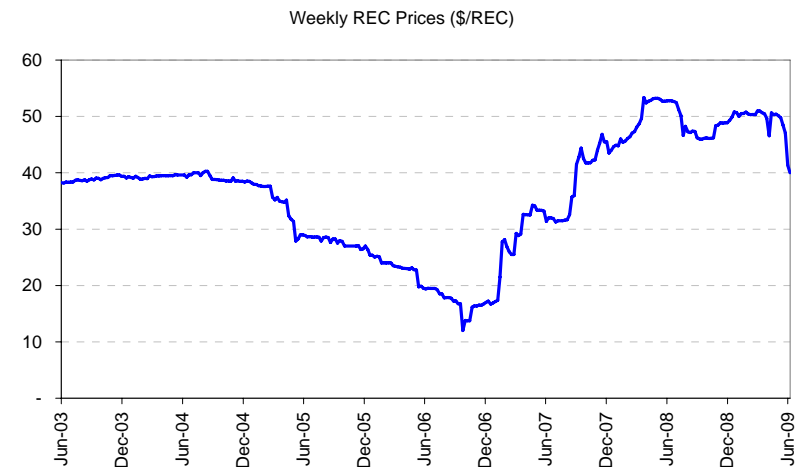
- Funding is the key challenge
  - Who can fund is the biggest issue – and the size of the funding is the problem
- Consider Solar Flagships for example:
  - \$1.6B to leverage \$3.2B, \$4.8B total
  - Assume three projects, each of \$1.6B
  - \$1.6B is 1/3 of TRUenergy!
- Utilities are not technology developers by nature
  - Utility investors seek stability in return for low returns
  - Utilities will not buy / develop risky technology
- Utilities will deploy technologies with the right risk profile
  - Public funding of the technology risk is essential
  - Venture capital type funding is not big enough for the challenge (e.g. \$1.6B for a single project is bigger than most funds!)

## Commercialisation Stages



# Planning for 2020 is easier technologically, but still a challenge commercially

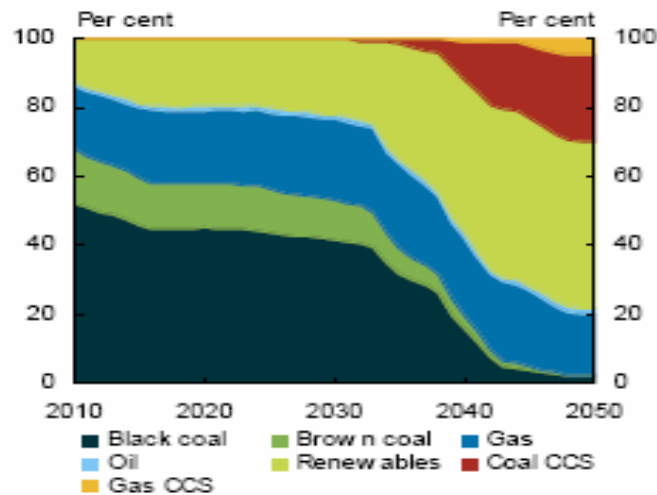
- The major policy drivers driving industry economics are becoming clearer
  - Carbon Pollution Reduction Scheme
  - Renewable Energy Target
  - Energy efficiency schemes
- Likely activities from these policy drivers include:
  - Consumer Energy Efficiency, e.g. Light bulbs (CFLs) / Solar Hot Water
  - Wind farms (intermittent)
  - Open cycle gas turbines for peaking power and wind balancing
- However price & cost uncertainty means commitment to 10 year+ investments is challenging
- A volatile REC price delivers highly efficient outcomes but volatility = uncertainty of returns



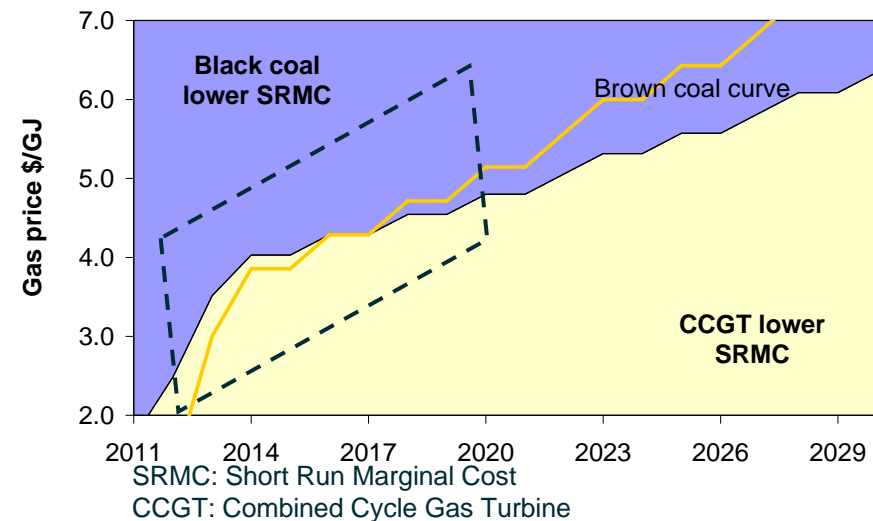
# Pre-2020, a key question is whether we will see brown coal replacement delivering significant domestic abatement

## Treasury Modeling

CPRS -5 scenario



## Treasury CPRS-5 carbon price profile



Australian gas and carbon prices may bias economics towards purchasing international permits rather than physical abatement

# TRUenergy's development strategy in the midst of technological and commercial uncertainty is to develop options to execute when economic

- Develop and deploy existing technologies
  - Wind (when supported by market signals)
  - Gas (open and combined cycle)
- Participate in emerging technologies
  - Geothermal
  - Coal gasification and CCS
  - Solar options
- Why participate in all technologies?
  - We don't know which will win!
- In the merchant market, flexibility is key



# So can coal and renewables fit together in TRUenergy's Australian portfolio?

- The answers are clear:
  - o In the short term they have to
  - o In the longer term we do not know
- Some other observations:
  - o If we have limited funds, we cannot afford to avoid coal based solutions, CCS is forecast to be cheaper than alternatives
  - o Energy storage is more important than improvements in renewable generation technology for enabling wide scale deployment of renewables
  - o Emission abatement in the domestic energy sector is not a given with international permit trading without RET like mechanisms